UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/608,300	06/27/2003	Srinivas Doddi	509982005500	9021

7590 10/06/2005		

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EXAMINER
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ART UNIT	PAPER NUMBER
2121	

DATE MAILED: 10/06/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

PTO-90C (Rev. 10/03)

Office Action Summary	Application No.	Applicant(s)
	10/608,300	DODDI ET AL.
	Examiner	Art Unit	
	Nathan H. Brown, Jr.	2121	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE _(3)_ MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.
- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
  Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on _6/30/2005_.

2a)☒ This action is **FINAL**.   2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) _1-29_ is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) _1-29_ is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on _6/27/03_ is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All   b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)
1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
   Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413)
   Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

U.S. Patent and Trademark Office
PTOL-326 (Rev. 7-05)   Office Action Summary   Part of Paper No./Mail Date 092205

UNITED STATES PATENT AND TRADEMARK OFFICE

Examiner's Detailed Office Action

1. This Office is responsive to communications for application 10/608300, filed June 30, 2005.

2. Claims 1-29 have been reexamined.

Objections to the Claims

3. Claim 1 is objected to as line seven contains "...one or more parameters or the profile..."

which is unclear in the context and should be changed to "...one or more parameters of the

profile...". Appropriate correction is required.

Claim Rejections - 35 USC § 112

4. The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of
> making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to
> which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth
> the best mode contemplated by the inventor of carrying out his invention.

5. Claim 8 is rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement. The claim contains subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention. Claim 8 limits claim 7 by adding "dividing the dimensions of the training output data into a first partition and at least a second partition..." to the method of "transforming the training output data using principal component analysis." There is no description of possible or preferred methods of dividing the dimensions of the training output data. (*Examiner notes that there are 2^N ways of partitioning a N-dimensional vector into subspace vectors, not counting repeats of the elements in the N-dimensional vector in the subspace vectors; and if counting repeats, then an infinite number of ways to partition a N-dimensional vector.*) There is no description of identification of meaningful underlying vector elements for partitioning. Further, there is no description of the order of the transformations, i.e., principal component analysis (PCA) first then dividing the dimensions or dividing the dimensions then PCA. Further, no description of whether the division of the dimensions is uniform or non-uniform for each component vector after the PCA transformation. Further, no description of possible or preferred tradeoffs is given in the situation of one of the machine learning systems being more accurate for its respective partition of the output vector than another machine learning system for its part of the output vector.

Claim Rejections - 35 USC § 103

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness

rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth
> in section 102 of this title, if the differences between the subject matter sought to be patented and the prior
> art are such that the subject matter as a whole would have been obvious at the time the invention was made
> to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be
> negatived by the manner in which the invention was made.

7. Claims 1-6, 9-15, and 16-29 are rejected under 35 U.S.C. 103(a) as being unpatentable over

Singh et al. (USPN 6650422 B2) in view of *Wormington et al.* (USPN 6,192,103 B1).

Regarding claim 1. *Singh et al.* describe a method of examining a structure formed on a

semiconductor wafer (*see* col. 2, lines 14-17), the method comprising: obtaining a first

diffraction signal measured using a metrology device (*see* col. 3, lines 8-12); obtaining a second

diffraction signal (*see* col. 3, lines 12-15); comparing the first and second diffraction signals (*see*

col. 3, lines 12-15); and when the first and second diffraction signals match within a matching

criterion, determining a feature of the structure based on the one or more parameters or the

profile (*see* col. 3, lines 15-17). *Singh et al.* do not describe obtaining a second diffraction signal

generated using a machine learning system, wherein the machine learning system receives as an

input one or more parameters that characterize a profile of the structure to generate the second

diffraction signal. *Wormington et al.* describe obtaining a second diffraction signal generated

using such a machine learning system (*see*, Fig. 6 and col. 8, lines 37-40 and col. 5, lines 50-62,

Examiner asserts that genetic and evolutionary algorithms are machine learning algorithms.). It

would have been obvious at the time the invention was made, to persons having ordinary skill in

the art, to combine *Singh et al.* with *Wormington et al.* to construct the reflectance signature

database with virtually no user intervention (*see* col. 4, lines 8-15).

Regarding claims 2-3. *Singh et al.* describe the method, further comprising: prior to generating

the second diffraction signal, training the machine learning system using a set of training input

data and a set of training output data, wherein each of the training input data is a profile of the

structure characterized by one or more parameters, and wherein each of the training output data

is a diffraction signal corresponding to the profile of the structure (*see* col. 9, lines 7-13).

Regarding claim 3. Selecting the set of training input data from a range of profiles of the

structure is inherent in the method in that: prior to using the machine learning system (that is a

neural network) it must to be trained. Further, the training input and output data must be selected

before training can be conducted. Singh teaches that the database of signatures associated with

known feature profiles maybe utilized to input training data (*see* col. 9, lines 8-10).

Regarding claim 4. Singh teaches dividing the range of profiles into two partitions. (*see* col.2,

lines 25-36). Hence it is inherent to choose two machine-learning systems to learn both partitions

under the context set forth by Singh using selected input training data described in claim 3.

Regarding claims 5-6. The admitted prior art on page 1 of the specification [0003]states that the

diffraction beam (the output training data) can be analyzed using modeling techniques such as

wave analysis.

Regarding claims 9-10 and 15. *Kato* (USPN 6,665, 446 B1) teaches (col. 10, lines 28-32) that

neural networks and genetic algorithms are art equivalents and the basic training of a neural

network inherently consists of getting input training data, comparing output data with desired

values, and acting accordingly with the comparison. Official Notice is taken of the user of a

back-propagation algorithm.

Regarding claims 11-12. Singh uses the first diffraction signal to compare with profiles in

database (col. 3, lines 10-16). Singh also states that the database can be use to train a neural

network (col. 9, lines 7-15) that will replace database to generate diffraction signals to Compare.

Regarding claims 13-14. Official notice is taken that metrology device is used to measure

structure such as ellipsometer using dimension measurement such as n and k

values. (See U.S. Patent 5,793,480. col. 2, lin.35-42)

Regarding claims 16-29.   Claims 16-21 are computer program claims that implement method

claims 1-15 using instruction code and claims 22-29 are systems claims that implement method

claims 1-15 using various devices and computers. Therefore claims 16-21 and claims 22-29 are

rejected under the same rationale as cited in the rejection of rejected claims 1-15.

8. Claim 7 is rejected under 35 U.S.C. 103(a) as being unpatentable over *Singh et al.* in view of *Wormington et al.* as set forth above and in view of *Sirat et al.* (EPN 0 448 890 A1).

Regarding claim 7. Using principal component analysis to transform machine-learning system output data is taught (*see* p. 2, lines 39-41) by *Sirat et al.* It would have been obvious at the time the invention was made, to persons having ordinary skill in the art, to combine *Singh et al.* with *Sirat et al.* to obtain fewer and simpler calculations per iteration during training.

Applicant's arguments with respect to claims 1-29 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a). A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In

no event, however, will the statutory period for reply expire later than SIX MONTHS from the

mailing date of this final action.

Correspondence Information

Any inquiry concerning this communication or earlier communications from the examiner

should be directed to Nathan H. Brown, Jr. whose telephone number is 571-272- 8632. The

examiner can normally be reached on M-F 0830-1700. If attempts to reach the examiner by

telephone are unsuccessful, the examiner's supervisor, Anthony Knight can be reached on 571-

272-3687. The fax phone number for the organization where this application or proceeding is

assigned is 703-872-9306. Information regarding the status of an application may be obtained

from the Patent Application Information Retrieval (PAIR) system. Status information for

published applications may be obtained from either Private PAIR or Public PAIR. Status

information for unpublished applications is available through Private PAIR only. For more

information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions

on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-

9197 (toll-free).

Anthony Knight
Supervisory Patent Examiner
Tech Center 2100

Nathan H. Brown, Jr.
September 30, 2005